

MOTOR-BOAT FRACTURES.

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SINCE the days of prehistoric man certain occupations have been productive of certain peculiarities of physical development and have been attended by certain accidents as direct results. Were records available of the physical condition of the early hunters we would find "bow-fingers" as well as bow-legs. With the advance of civilization these physical characteristics became more numerous and more generally recognized. A monograph, for the use of expert criminologists in Paris, describes several hundred varieties of callosities and deformities caused by occupation. Hardly a trade can be mentioned that does not produce certain well marked physical characteristics if the same posture or motion be continued for any length of time.

Such stigmata are of chief value to men who are working with Bertillon methods for the purpose of identifying individuals, but at times they are of such severity as to require medical treatment. In the domain of surgery, "housemaid's knee," "miner's elbow," and "porter's shoulder" have been recognized for years, while "writer's cramp" is equally well known to physicians in general.

The occupations that produce such lesions are, in most instances, necessary ones and can hardly be given up or avoided; but of recent years, with the advent of many new kinds of "sport," it has been found that the favored few who have little to do but play, instead of work, are by no means free from similar conditions. "Base-ball finger" was the first of these to appear and then, in turn, came "lawn-tennis elbow," "football knee," "runner's leg," "catcher's shoulder," and "bicycle face."

The list of games that may demand a price of similar value

in return for their enjoyment might be extended to a considerable length. Foot-ball, tennis, base-ball, hand-ball, lacrosse, bicycling, hurdling, and foot-racing all contribute to the list. In the more violent forms of athletic exertion "putting the shot" not infrequently causes serious sprains.

CASE I.—Mr. W. J. D., a doorman in the police department, while engaged with some of his friends in "putting the shot" felt a sudden and severe pain in his right elbow. He paid no especial attention to the matter until the following morning when his arm was found to be greatly swollen and irregularly ecchymotic. The disability continued. He reported sick but did not admit the cause of the injury at first, stating that he was subject to rheumatism. Some months later a considerable contracture persisted and when he first came under my care the joint was almost useless. The exact nature of the trouble was only determined by the use of Roentgen rays. The radiograph showed no injury to the bones. He was accordingly sent to the hospital and anesthetized with gas. As soon as volition disappeared the joint was fully extended and after free flexion and extension it was secured in full extension by a splint. The following day, because of some pain in the arm, he removed the splint and the arm at once returned to its original angle of contracture. He declined to have anything further done to the arm and now, about 3 years after the injury, the contracture still persists (Fig. 1).

Even the simple and ancient game of quoits is not free from danger to the participants, aside from the risk of being struck by the quoit itself. The sudden twist of the wrist given as the iron leaves the hand may in itself do damage.

CASE II.—Mr. T. K., a patrolman in the police department, while playing a game of quoits felt something snap in the right wrist and pain and swelling developed after a short interval. The radiograph showed that the ligament had torn loose from the styloid process of the ulna and that a considerable separation of the bones at that part of the wrist joint was the result. Immobilization for about a month was needed to secure good functional result (Fig. 2).



FIG. 1.—Radiograph showing contracture of right elbow joint. Sprain caused by "putting the shot."



FIG. 2.—Radiograph showing sprain of right wrist with rupture of styloid ligament, caused by "pitching quoits."

During the bicycle craze a number of cases were observed by the writer in which the constant vibration of the handle-bar during long rides over rough roads produced numbness and even temporary paralysis of the fore-arms, and in one or two cases, the hard and small wooden saddle caused similar conditions of the legs, combined with severe sciatica. The vibration of the machinery and steering wheel of the modern automobiles has already caused similar symptoms in chauffeurs. Even physicians who drive their own cars are not exempt, and the writer has, at the present time, under observation a surgeon whose skill as an operator is seriously impaired by the wide muscular tremor that his hands have acquired since he joined the ranks of those who use horseless carriages.

Still more recent are the injuries that have been received by those who are using motor-boats, and to these the present article especially directs attention. In most instances the machinery of the boat, usually with gasoline as a motive power, is started by hand. The more or less heavy balance wheel of the engine has a permanent handle projecting from the rim, or a heavy brass or iron rod sunken in a socket and held in place with a spiral spring when not in actual use. When the engine is started this handle is seized and the wheel turned quickly around. If the gasoline and air mixture is right and the electric spark really sparking, a single turn may be all that is necessary to start the series of explosions within the cylinder that drive the engine. It frequently happens that the conditions are not right for a great variety of reasons which can be learned by the hour from the owner of any motor-boat. In any event the wheel has to be turned a number of times before the engine will start; one hand is used, it becomes tired; the other is used, it, too, becomes tired; then both are used. Ultimately, if all goes well, the shaft becomes heated, or the water dries out of the gasoline tube, or the carburettor produces a good mixture, or something else happens and the machinery starts, sometimes with great rapidity. The handle escapes from his grasp, flies around, and before the man has time to get out of the way he is struck by it on the hand. In case the

handle is in a socket, the spring is supposed to bring it flush with the rim of the wheel as soon as it is released, but if the handle is rusty, or the spring is weak, or the handle binds in the socket, this does not always occur, and injuries with this type of handle are as frequent as when a stationary pin is used.

The injuries that result from this impact are usually trifling, but the following series of cases which occurred at a single wharf during the past summer will show that some of them may be very serious. Inquiry at other places would doubtless give other and perhaps larger lists.

CASE III.—Mr. A. D., aged 30, while starting his gasoline engine was struck on the calf of the left leg by three successive revolutions of the fly wheel. The bones of the leg were not fractured but the clothing was torn and a considerable portion of the gastrocnemius muscle was torn away in the badly contused and lacerated wound that resulted. The first impact was so violent that the leg was numb and he could not move for a moment or two. Considerable loss of power in the leg still remains after some months and a marked limping gait will probably be permanent.

CASE IV.—Mr. J. S., aged 35, injured in a similar manner. The handle struck his right hand before he could get it out of the road and badly lacerated the index and middle fingers, breaking the middle phalanx of the latter. Recovery uneventful.

CASE V.—Mr. C. S., aged 22, was struck by the stationary handle of his gasoline engine and the first phalanx of the index finger of the left hand was fractured. Recovery uninterrupted.

CASE VI.—W. S., a sergeant of police, aged 42, was injured in a similar manner: the sparking adjustment was wrong and the wheel flew backwards, the handle striking him on the back of his right hand. When this case was seen after twenty-four hours there was considerable swelling and ecchymosis of the hand. At the first of the examination a distinct crepitus was felt but only once, and continued manipulation could not again elicit this symptom. In the belief that there was some obscure form of fracture present, the patient was radiographed and it was discovered that the blow, occurring on the side of the metacarpal of the right index finger, had caused a linear fracture



FIG. 3.—Radiograph showing linear fracture of metacarpal bone of right index finger. Caused by recoil of handle of motor-boat engine.



FIG. 4.—Radiograph showing "tent-shaped" fracture of fourth right metacarpal bone. Caused by recoil of handle of motor-boat engine.

extending proximal into the joint. Only at the very tip of this fragment could crepitus be felt (Fig. 3). A moulded metal splint was used and an excellent result was obtained. At the end of five weeks he was again able to return to desk duty. Such a linear fracture is unusual.

CASE VII.—Mr. C. B., aged 34, was another victim. In his case also the explosion took place at the wrong phase of the engine cycle and he was struck on the under side of the right hand in the middle of the palm. The fourth metacarpal bone received the brunt of the impact and was fractured at its middle in an angular direction so that the ends of the fragments of bone formed a tent-like elevation upon the dorsum of the hand. The deformity produced was more pronounced than usual, for in most instances the adjacent bones act as splints and the broken bone is held in good position in this manner. The angular deformity is shown in Fig. 4. With the aid of the radiograph a pad was placed over each extremity of the bone on the palmar side and a single pad over the angular projection on the dorsum. Two small glass rods, with rounded ends, on each side of the bone, corrected the tendency to lateral displacement and with these occurred in a moulded metal splint the result was excellent.

CASE VIII.—Mr. B. C., aged 33, was injured by a similar blow upon the back of the right hand. His hand became much swollen and discolored but he thought it merely a bruise and did nothing for it until two weeks had passed when the continuance of the symptoms caused him to come for treatment. With the former cases in mind, although no crepitus could be detected, a radiograph was made and a transverse fracture of the fourth right metacarpal bone was found (Fig. 5). The bone was in perfect alignment and was held so by the action of the two adjacent metacarpal bones. This plate is also interesting as it shows another form of injury received in play, a "base-ball finger," due to a fracture of the first phalanx of the little finger, received some years ago. In this case a simple splint for immobility was all that was needed to secure an excellent result with no deformity.

CASE IX.—Mr. F. S., another member of the police force of the city, aged 48, received a more serious injury. He was struck by the flying handle upon the left wrist and the radius was fractured in two directions giving lines like the letter X (Fig. 6).

The force of the impact was received upon the dorsum of the wrist and the resulting deformity was that of an exaggerated Colle's fracture. Good recovery in five weeks.

CASE X.—Similar to Case VII but still more serious, was that of Mr. W. F. who was struck in a similar manner upon the wrist, but from beneath, by the flying backward of the released handle. A compound fracture of the right wrist resulted and considerable laceration and contusion of the soft parts about the broken radius and ulna. So severe was this injury that it seemed probable an amputation might be necessary. This was averted, however, by carefulness and cleanliness, and a fair result was obtained.

CASE XI.—Drowning does not seem at all likely to occur as a result of such an injury, but this was nearly the fate of Mr. A. S., a slender man of 23, who was engaged in starting the engine. The explosion again occurred at the wrong cycle, the handle flew backwards and struck his right wrist on the upward turn of the wheel. The force of the blow was so great that not only did he sustain a compound fracture of the right wrist but he was thrown bodily overboard into the waters of the bay. He was no swimmer and was so stunned by the injury that, had not help been promptly at hand from those who saw the accident, the victim would have drowned. It is probable that some portion of clothing became entangled in the handle of the wheel and so gave sufficient attachment to throw him overboard. A serious illness resulting from the immersion developed, in addition to the shock of the compound fracture, and operative procedures and it was some weeks before he finally recovered. It is not unlikely that one or two drowning accidents noted in the daily newspapers during the past season occurred in a similar manner, as motor boats have been found running without a driver and the body of the man was afterwards found injured and drowned.

Similar injuries occur during the "cranking" of an automobile, and once the attention of the surgeon is directed to the subject it is surprising how many cases can be secured. During the past month while the matter was uppermost in his mind the writer has had his attention called to a number of such accidents.



FIG. 5.—Radiograph showing transverse fracture of fourth right metacarpal bone. Caused by recoil of handle of motor-boat engine.



FIG. 6.—Radiograph showing X-shaped fracture of left wrist caused by recoil of handle of motor-boat engine.

CASE XII.—W. B. B., a physician, while engaged in starting the engine was struck on the right wrist by the rebound of the crank at the time of the primary explosion. The radius was broken close to the wrist joint and in two places, very similar to those shown in Fig. 6. This physician reports that he has had about six cases, similar in character, in his personal charge during the past year. He lives in the neighborhood of a garage and they have been sent to him for immediate treatment.

CASE XIII.—Dr. C. D., another medical man, met with a similar experience. In his case instead of pushing down on the handle with the arms rigid he was nearly at the highest point of the circle when the explosion occurred. The crank did not leave his hand but the backward impulse was so sudden and so violent that the radius was broken completely across; the ulna was not injured (Fig. 7). The deformity at the time of injury was extreme.

CASE XIV.—Mr. T. A. R., while cranking his machine, had the spark too far advanced and the explosion occurred at the wrong phase of the engine; the handle flew backward, striking him below the knee, breaking both bones of the leg.

Two cases have been called to the writer's attention in which the patella was broken. Minor injuries to the leg, and particularly to the knee are common. The daily press (*New York Sun*, November 1, 1906) has recently reported a case in which the nose was broken and the skull was also fractured.

Type of Fracture.—The fact that the initial velocity of the flying handle is much greater than that of the human body, in case of a fall, or of that of falling timbers, stones, and the ordinary causes of fracture in everyday life, has a marked effect upon the lines of fracture and causes them to resemble those produced by large calibre projectiles without the penetrating effects. The fracture, as a rule, occurs at the point of actual impact, and is rarely transmitted to the weaker parts of the bone. So localized, indeed, is the injury that fragments of bone may be broken off or such small bones as those of the carpus may be individually broken. The lines of fracture are, as a rule, quite straight and the direction taken may be most unusual.

Diagnosis is often quite difficult, and the use of the fluoroscope and radiograph is imperative in cases of doubt.

The hand and wrist receive the greater number of injuries, but the fingers are pushed aside easily and quickly so that fractures in the phalanges are not common. On the other hand, the metacarpal bones seem to be fractured most frequently, and injury to the carpus, sprains or even an actual fracture is not rare. When the force of the blow is expended directly upon the fore-arm or leg the injury may be more severe, and compound fractures are not uncommon in these localities.

Etiology.—When these cases are studied to determine the cause of the explosion taking place when the driver is unprepared or during the wrong phase of the engine cycle, it would appear that the majority are due either to carelessness or to ignorance. Too many persons buy a car or a boat, are taken out for a trial trip, are shown the essentials of starting and of stopping, buy the machine, and fancy that by reason of having paid the purchase money they are thereby granted the degree of mechanical engineer. The dangers are slowly becoming known and actual schools for instruction for the complete construction and management of motor-boats are now established. The first of all to be established is maintained by the Y. M. C. A. of this city, and the practical demonstrations of their craft on the Harlem on Friday and Saturday afternoons, with the numerous apparent accidents, have caused the uninitiated to call it the "Jonah Boat."

The best of instruction cannot prevent carelessness, and the attitude taken by the manager of a motor company, who sustained a badly injured wrist with fracture of one of the carpal bones and a resulting excision and did not care to have the case reported for several reasons, shows that familiarity does not protect against the possible danger.

All agree, that most of the accidents occur while the handle is being pushed downwards with the weight of the body upon the rigidly held and extended arms. If the handle is pulled up it is safer, and if the explosion does occur at that time

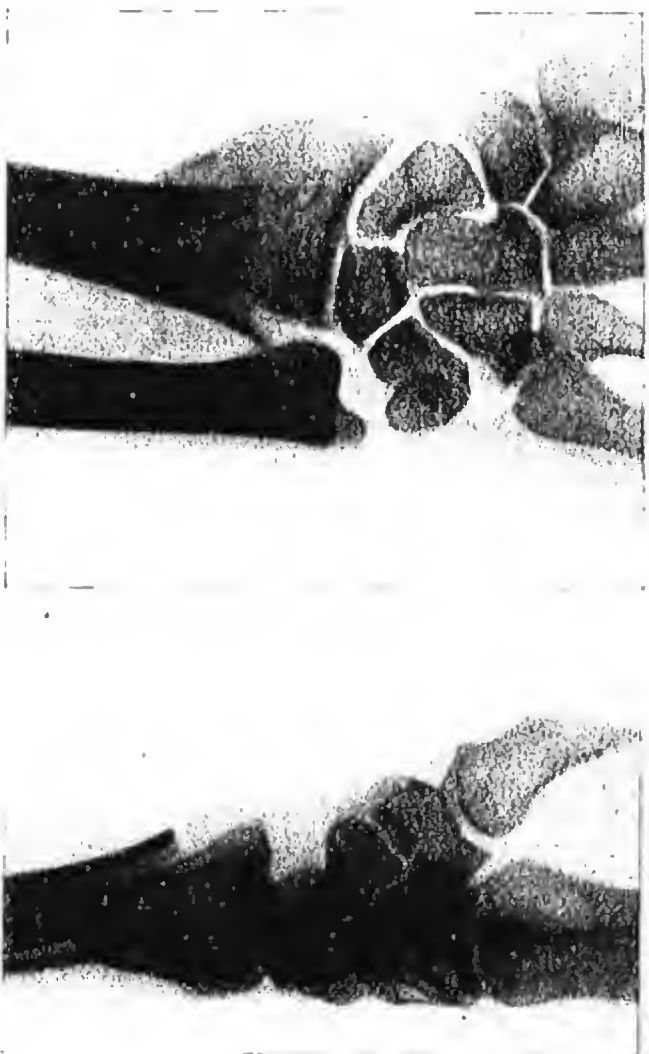


Fig. 7. Radiograph showing fracture of right radius caused by recoil of handle while "cranking" automobile.

the handle flies away from the grasp, and is much less apt to do damage to the driver. In automobile accidents the legs receive the larger number of injuries as the crank is higher from the ground. In the automobile, however, the force is transmitted from the crank to the engine through the medium of a ratchet, so that the crank does not continue to revolve. Then, too, if the effort be made always to stand clear of the crank and apply the force by pulling up instead of pushing down, the chance of accident is greatly lessened.

With motor-boats, especially those whose engines have been placed in sail-boats, cat-boats, dories, and the like, to give auxiliary power when needed, the mechanism is much more simple and the space in which to avoid the flying handle is much less. Accidents are common enough in both classes, and with a little effort the above record could be greatly amplified.